Game Changing Development

Advanced 1.65 Micron Seed Laser for LIDAR Remote Sensing of Methane (Seed Laser)

Completed Technology Project (2016 - 2018)

Project Introduction

Develop a high-power, tunable monolithic semiconductor DBR laser at 1561nm, to be used as a seed source for the NASA's methane measurement LIDAR instrument

Anticipated Benefits

NASA Unfunded: This project enables Earth Science Methane observations as described by the Earth Science Decadal Survey which called explicitly for cost-effective methane technology and measurements at all latitudes and NASA's Astrobiology Strategy for the Exploration of Mars which called for ...global-scale measurements of atmospheric gases, with sufficiently high precision and accuracy to allow detection and characterization of trace gases...#OGA: Agencies such as the EPA need cost-effective methane detection systems to monitor a large variety of commercial sites such as natural gas pipeline networks, fracking and gas drilling, waste water treatment plants, landfill surface emissions, coal mines and animal husbandry sites.#Industry: A low-cost, high performance miniaturized 1651nm seed laser source is a key advancement for the development of low-cost, high performance, compact LIDAR systems for methane spectroscopy, which may be deployed by commercial providers on small satellite platforms or UAV's. #Nation: Atmospheric methane concentrations on Earth have been increasing as a result of increased fossil fuel production, rice farming, livestock and landfills, and the thawing of the Arctic permafrost. Better knowledge of the methane global distribution, sources and sinks is imperative for a more accurate assessment of its impact on global climate change. The development of low-cost, accurate remote methane sensing technologies is becoming increasingly critical in order to analyze methane concentrations and distributions throughout the atmosphere.

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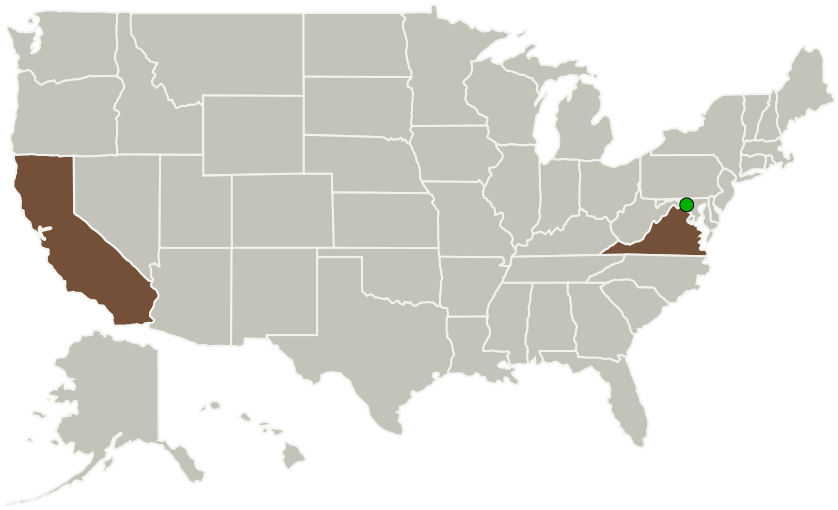
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Freedom Photonics, LLC	Lead Organization	Industry	Santa Barbara, California
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
California	Virginia

Project Transitions

June 2016: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Freedom Photonics, LLC

Responsible Program:

Game Changing Development

Project Management

Program Director:

Mary J Werkheiser

Program Manager:

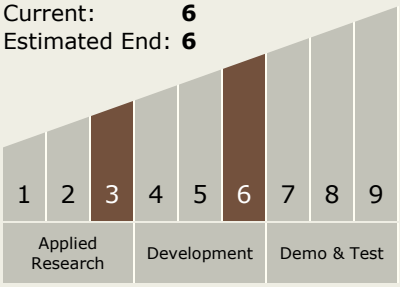
Gary F Meyering

Principal Investigators:

Leif Johansson
Milan Mashanovitch

Technology Maturity (TRL)

Start: **3**
Current: **6**
Estimated End: **6**



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September 2018: Closed out

Closeout Summary: The Methane Seed Laser project objective was to develop a high power, 1,651 nanometer Distributed Bragg grating Reflector (DBR) laser that would enable effective space-based LIDAR detection of methane. A single, high power DBR laser can replace current multiple slave laser and associated ph ase locked loop technology which will reduce cost, hardware complexity, and ma ss. The effort with industry partner Freedom Photonics developed and delivered optimized versions of advanced, miniaturized, tunable semiconductor-based see d lasers needed for practical implementation of a space-based methane sensing instrument. Radiation-hard design approaches were used to manufacture the DB R tunable seed lasers with a power level of more than 100 mili-Watts at 1651 na nometers. Several modules were successfully designed, manufactured, tested, a nd delivered to NASA for evaluation and integration into Lidar instruments. Spac e-based methane detection will advance the current understanding of gas distrib ution and processes which are primarily established from ground-based, in-situ measurements from global monitoring networks. Active space-based sensing tec hnology will be key to obtaining global measurements of methane with broader coverage and sampling precision.

Project Website:

https://www.nasa.gov/directorates/spacetech/game_changing_development/in

Target Destination

Earth